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SOME PRINCIPLES OF SPACE STRATEGY
(OR "CORBETT IN ORBIT")

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SOME PRINCIPLES OF SPACE STRATEGY
(OR "CORBETT IN ORBIT")

I. Introduction

In his 1996 essay, "The Influence of Space Power upon History,"[1] Colin Gray traced the increasing importance of satellites to the conduct of warfare and lamented the rudimentary state of study of what he calls "space power" – the ability to use space while denying its reliable use to any foe. "Where," Gray concluded his essay, "is the theory of space power? Where is the Mahan of the final frontier?"

Although Gray's call for a better elaborated theory of the strategic use of space is on the mark, he may have chosen the wrong theorist to use as an example. For the foreseeable future, the British naval theorist Sir Julian Corbett, rather than Alfred Thayer Mahan, is likely to be the more reliable guide to those seeking to understand the meaning and proper use of space for military purposes.

"Corbettian" reasoning can cast light on America's deepening predicament as it becomes ever more dependent on increasingly vulnerable space "lines of communication." Viewing an information-dependent America in Corbettian terms reveals to us a country both less familiar and more perilously situated than the one we are accustomed to. Although the Corbettian framework does not prescribe solutions, it does hint at some possible approaches to take. And, by clarifying the problem, Corbett gives us better insight into which proposed solutions are the most promising.

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[1] Comparative Strategy, Oct.-Dec. 1996, pp. 293-308.

II. Corbett at Sea ….

Sir Julian Stafford Corbett's best-known work is a 1911 compilation of lectures, entitled Some Principles of Maritime Strategy. [2] In it, Corbett made clear that, by "maritime strategy," he meant the naval aspect of the overall military strategy to be pursued by a maritime nation such as Great Britain. "By maritime strategy," Corbett wrote, "we mean the principles which govern a war in which the sea is a substantial factor." For "it scarcely needs saying that it is almost impossible that a war can be decided by naval action alone." Accordingly, Corbett concluded, "the paramount concern …. of maritime strategy is to determine the mutual relations of your army and navy in a plan of war."[3]

Although in many respects Corbett's views complement, rather than contradict, those of Mahan, Corbett did consider his views to be fundamentally at odds with Mahan's in important ways. For example, Corbett's joint-arms conception of maritime strategy can fairly be contrasted with Mahan's more naval-focused point of view emphasizing decisive battles fought between blue-water fleets, with the control of the sea as the stake.[4] Mahan famously conceived decisive sea battle to be the means of seizing control of the sea. It was the act that

> drives the enemy's flag from (the sea), or allows it to appear only as a fugitive; and which, by controlling the great common, closes the highways by which commerce moves to and from the enemy's shores.[5]

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[2] Naval Institute Press, Annapolis, Maryland.
[3] *Ibid*, pp. 15-16.
[4] Mahan's most famous work is The Influence of Sea Power Upon History, 1660-1783, first published in 1890 (available from Dover Publications, New York)
[5] *Ibid*, p. 138.

Corbett agreed with Mahan concerning the importance of preventing enemy commerce from moving freely about the sea, but his emphasis was different. Corbett believed that decisive sea battle was both difficult to achieve and unnecessary. Naval power, he believed, could better strangle commerce "by the capture or destruction of the enemy's property, whether public or private."[6] Rather than seeking out the enemy's battle fleet, it was more profitable to control his ports and maritime choke-points, thus both threatening his commerce directly and, possibly, luring his fleet to its destruction.[7] Moreover, whereas Mahan viewed sea control as absolute and permanent once the enemy's battle fleet had been vanquished, Corbett emphasized the conditional nature of sea control. It could be either positive (the ability to travel freely on the sea oneself) or negative (the ability to deny this capacity to the enemy). It could be either local or global, permanent or temporary.[8]

III. …. and in Space.

But what can an Edwardian naval theorist tell us about the conduct of space warfare in the 21st century? First off, we can see that, for the foreseeable future, warfare in space is unlikely to involve clashes between "Mahanian" battle fleets consisting of "blue-space" war-craft, whether manned or unmanned. For the time being, at least, Gray's "space control" is likely to be contested by less dramatic means. Secondly, however important operations in space will be to warfare, it appears doubtful that wars will actually be decided in space. In the early part of this century, operations in space

[6] Corbett, *op cit*, p. 99.
[7] Corbett, *op cit*, p. 323.

will continue to be a crucial component of joint military operations, along with land, sea and air forces, rather than an independent form of warfare. In true Corbettian fashion, the challenge for strategists, at least in the first decades of the 21st century, is likely to be to work out the mutual relations of space and "Earth" forces in an overall plan of war.

Space commerce. Over the next few decades information, in all its manifestations, is likely to remain the principal reason for using space at all. Fundamentally, satellites today perform two functions -- they collect information and they transmit it. Consequently, the real meaning of "space control" will be the ability to collect and move information in space while denying that ability to adversaries. Information is the "trade goods" of the early space age. Gathering and moving these goods is what we mean by "space commerce." Both Mahan and Corbett would probably agree that disrupting the enemy's commerce in information while protecting one's own will be the fundamental task of space warfare.

Power projection. Military information – those data gathered in space and transmitted to Earth in order to assist Earth-bound warfare -- is subtly different from commercial information. The use of military information is a form of power projection onto the Earth's surface – and, from a satellite's-eye view, the whole of this surface is the "littoral" of a unified earth-space theater of warfare. The potential for this sort of power projection is suggested by the fact that, if 75 percent of the Earth's population lives on or near its sea-bound littorals, 100 percent lives on the space-bound littoral. Here is another hint that Corbett, with his joint-forces view of warfare, may be a more useful guide to war in space than his American contemporary.

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[8] *Ibid*, p. 104.

In addition, the control of space seems likely to be more Corbettian – that is, more conditional, local and temporary – than it is to be Mahanian and absolute. Not all orbits are equally vulnerable to attack by an enemy (for example, satellites in geo-synchronous orbit are, for now, safer from disruption than are lower orbits). More importantly, space control, like Corbettian sea control, will come in both positive and negative varieties – and the distinction between them will be both more marked and more fundamental in space than it is at sea.

IV. Offense and Defense in Space

At present, the means for exercising negative space control – the ability to deny an adversary the use of space – are fundamentally different from that of exercising positive space control – the ability to use space oneself. Positive control is exercised by placing satellites in orbit and using them for their intended purposes. Negative control can be more effectively exercised from the Earth's surface, with weapons designed to dazzle sensors or to jam communications links. Of course, the Soviet Union experimented with a space-born "ASAT" (anti-satellite weapon) in the 1970s and 1980s, but it was rather crude and probably inferior to less expensive and unwieldy anti-satellite measures that can be taken from the Earth's surface.[9]

Negative space control is considerably easier to exercise than the positive variety. Putting a satellite in orbit is complicated and expensive. Tinkering together a satellite

[9] The United States also developed, but did not deploy, an anti-satellite weapon. It, however, was not based in space. The U.S. weapon was carried aloft by an F-16, then launched in the upper atmosphere.

jamming device from parts bought commercially is simple and cheap .[10] If a $100 million communications satellite can be placed in jeopardy by, say, a $100 jamming device bought at Radio Shack, then we must conclude that space denial has a great advantage over positive space control. Put another way, in space offense is more potent than defense.

Moreover, this mismatch is likely to persist, because the *marginal* cost of threatening satellites will be much less than the marginal cost of protecting them. We can imagine millions of dollars being spent on measures to protect a communications satellite from our $100 jamming device – and these measures then being defeated by an adversary willing to move up to a $1,000 jammer. Naturally, this state of affairs will also favor the United States whenever it tries to disable the space-borne communications of an enemy. The U.S. is, however, the most prolific user of space and the power most dependent upon it. The advantage of the offensive in space is, on balance, therefore, likely to work against us.

V. Imagine There's a Country….

The United States is accustomed to think of itself as happily removed from many of the problems that less fortunate countries must confront daily. We at once are the world's largest trading nation and have the world's largest economy. We are a large country, flanked by two great oceans. These circumstances afford us a considerable, if not absolute, immunity from direct attack, a prosperity that is not wholly dependent upon

[10] Reportedly, a 30-watt laser has been able to blind an earth-observing satellite in low-earth orbit. See Binnendijk, Hans and Kugler, Richanrd L. (eds.), "Strategic Assessment 1999," National Defense

our commerce with others and a margin of error in conducting our foreign relations that is the envy of most other nations.

But let us take a few minutes to look at America through a different lens, one that focuses on the flow of information and its importance to the United States. For, in addition to its other characteristics mentioned above, the United States is the leader of a revolution in the technology of gathering, analyzing and transmitting information. And much of this information travels through space. We use space-dependent information technology to do our shopping, to withdraw money from the bank, to sell our services abroad and to conduct our wars. We are increasingly dependent on the flow of information through space for our convenience, our prosperity and our security.

If we close our eyes, then, and think of our country in terms of its dependence on the flow of information through space, a very different America comes into focus -- one more constricted and vulnerable, but also, perhaps, one more strategically interesting than the country we are accustomed, somewhat complacently, to inhabit.

"Info-America" is much more dependent on "trade" (the flow of information through space, that is) than is real America. Info-America's ATM machines won't even work if its "commerce" is disrupted. Info-America's "merchant marine," unlike that of real America, has not withered from competition and disuse. In accordance with the importance of trade to Info-America, it possesses a large commercial fleet (of satellites) to carry traded goods from port to port and even to "produce" these goods (with space-borne sensors). Info-America also uses foreign satellite-vessels to carry quite a few of its traded goods. These goods don't always travel directly from port of embarkation to port of destination. They must sometimes pass through ground-based satellite relay stations.

University, Washington, DC, p. 309.

These “choke-points,” situated on sovereign territory, are vulnerable to disruption or to permanent closure.

Info-America’s formidable, information-hungry military also depends increasingly on “trade.” And, although the military owns some of its own satellite-vessels, most of its information “goods” – 70 percent in the year 2000[11] -- are carried by leased commercial vessels, some of them foreign. Some of the satellites that the military does control are so few in number and expensive – for example, imagery satellites – that they may be considered the space-faring equivalent of capital ships. But an imagery satellite is much easier to “sink,” and much harder to protect, than an aircraft carrier.

Info-America’s problems go even deeper. For it is also highly dependent on *domestic* trade – information travelling through space from point to point within its own borders. Info-America thus relies heavily on its “inland waterways” to move the information cargo essential to the nation’s wellbeing. In addition, because information must flow constantly and without interruption if such industries as telecommunications and finance are to function, much of Info-America’s trade is on a “just-in-time” basis. It is as if, in normal America, in order to buy a quart of milk you had to rely on a truck delivering it to the store just as you walked in.

Finally, and crucially, Info-America’s information trade is highly vulnerable to attack and disruption. Unlike normal America, with its long coastline and many harbors, Info-America has only a very small number of ports (satellite launch sites). Its merchant fleet – its satellites – can be disabled by enemies operating from distant lands. Even its military satellite-vessels are unarmed and unarmored. Given that anti-satellite weapons may be both simple and within the reach of the most modest budget, individuals – call

them what you will; "non-state actors," "space hackers" or "pirates" – may also threaten our space fleet. If one of Info-America's merchant satellite-vessels is sunk or damaged, we may not know who is responsible – or even whether the vessel was damaged by an enemy or by some natural phenomenon, or simply malfunctioned. Like ship owners before the invention of radio standing gloomily on a pier, all we may know for certain is that our cargo did not arrive.

The potential threat to Info-America's information traffic, both commercial and military, could be both anonymous and highly dispersed. It might consist of jamming devices, lasers and other ground-based anti-satellite weapons scattered throughout the land surface of an enemy's territory, moving about on the sea or even operating from countries friendly to the United States – for example, from the rooftop of an embassy of the enemy nation. Even if the enemy's "fleet" of anti-satellite devices did not succeed in crippling American commerce or its ability to wage war using space-based information, it could complicate U.S. strategic calculations. Even a credible but unrealized threat to our ability to use space could compel military planners to resort to less than optimal strategies for fear that their preferred strategy might be too easily disrupted. In this way, the enemy's unused anti-satellite capability could play the role of Corbett's "fleet in being."[12]

One further point -- commerce along Info-America's "inland waterways" is as vulnerable as its foreign trade. The laws of orbital mechanics ensure that even those satellites we use entirely for moving information from point to point within the U.S. will also pass over many foreign countries. Truly, Info-America's strategic situation is more parlous than that of our more familiar "real" America.

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[11] *Ibid*, p. 304.
[12] Corbett, *op cit*, p. 165.

VI. Deception and Disruption

Actually, our situation is even more complicated than the equation of information flow with traded goods reveals. For information, unlike ordinary goods, can be *distorted* as well as *disrupted*. Information can be used to deceive. An enemy can plant false information, perhaps by capturing the use of our own means of communication. The Global Positioning System can easily be disabled, at least locally, by a low-power jamming transmitter.[13] In principle, however, it could also be corrupted, so that users would receive false estimates of their positions. In contemplating such problems, we leave behind the realm of Corbett and Mahan for that of Sun Tzu. To his famous aphorism that "all warfare is based on deception," he might have added "especially if your enemy depends more on information than you do."

VI. In Search of a Strategy for "Info-America"

How should Info-America's leaders respond to the security challenges they face? Their basic problem is that, just as our primary military use of space is likely to be the projection of power *into* the "littoral," satellites are most likely to be attacked *from* the littoral, rather than from space (because "killer satellites" are, for the foreseeable future, likely to be so much more expensive and less potent than ground-based anti-satellite weapons). It is as if an enemy's coastal artillery could threaten our fleet wherever it was in the world, including on our inland rivers. The physical separation of the satellites that

exercise positive space control from the ground-based weapons that exercise negative space control makes early 21st century space warfare fundamentally different from naval warfare. At sea, exercising positive control with a warship (i.e., travelling along a sea-lane) automatically allows one to challenge the negative control of the enemy (who must travel the same lane). In space, this is not so.

History illuminates our challenge. The Battle of the Atlantic, that desperate struggle to maintain Britain's life-giving sea-borne commerce, may seem a plausible analogy to our situation in case of a conflict involving space. Then, as now, commerce was threatened by a large number of relatively inexpensive, highly dispersed commerce raiders – U-boats then, perhaps ground-based anti-satellite weapons tomorrow; a 21st century *jeune ecole* gone wild. But the lessons of that battle seem to have little to offer to Info-America. Then, the Allies prevailed by building ships faster than the Germans could sink them – but we have seen that disabling satellites is likely to remain much easier and cheaper than launching and operating new ones. Then, merchant ships – aided by the Allies' possession of German naval ciphers -- got through to their destinations by avoiding routes frequented by German submarines. But Kepler's laws and limitations on on-board maneuvering fuel conspire to limit sharply a satellite's ability to ply unexpected orbits. In this respect, orbital travel may be more analogous to movement on land, with its restrictions caused by the folds and declivities of geography, than to passage on the open sea.

Corbett's maritime outlook does offer some encouragement to lighten Info-America's gloom. If satellite launching sites are the space-faring equivalent of ports, then "blockading" them, perhaps by physical attack, is an obvious way to deny our access

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[13] Binnendijk and Kugler, *op cit*, p. 304.

to space. And if satellite ground stations are the equivalents of maritime choke-points, then they are also promising targets for attack and disruption. But the United States is relatively invulnerable to attacks on ground stations on its own soil, casting doubt on whether an enemy could successfully challenge our ability to use both ports and U.S.-based choke-points through this particular Corbettian strategy. The U.S., however, with its ability to project power around the globe, might well be able to use this strategy against others.

Spreading the Risk. One way to face the challenge presented by dispersed ground-based anti-satellite weapons is to answer dispersion with dispersion. For example, large, geo-synchronous communications satellites could be replaced with great numbers of smaller, relatively inexpensive, redundant communications satellites in various orbits – Motorola's "Irridium" concept on a larger scale. By increasing the number of satellites an enemy would have to target, this concept could greatly complicate his task.

This may not work for some other satellites, however. For example, optical imagery satellites are large, heavy and expensive because their resolving power[14] is proportional to the size of their main mirror. Replacing these satellites with large numbers of small, inexpensive imagery satellites is not, therefore, possible.

But dispersion also has another dimension. By increasing its already substantial use of commercial satellites, the U.S. military could decrease its vulnerability to any one of them being disabled. The increasing number of foreign imagery satellites, some of them operated by foreign governments or commercial firms, may help guarantee that at

[14] That is, their ability to distinguish two nearby objects.

least some imagery will be available to our military even if its own imagery satellites should be disabled.

Dispersion of satellites, however successful, will have its limitations. Smaller satellites and improved computer processing techniques can greatly decrease the marginal cost of launching additional satellites. Still, the costs of building, launching and operating a satellite will remain substantial, even if they may drop over time. Consequently, it seems unlikely that technology can drive the marginal cost of launching and operating even a small satellite below the marginal cost of attacking that satellite from the ground. Dispersing our space assets may ease our problem, but not solve it.

Self-Defense. Other approaches could complement dispersion. Signal encryption, frequency agility and very large bandwidth communications can make signals both harder to detect and to disrupt. Military satellites could be equipped with "threat warning receivers" that would allow them to identify attempts to disable them. The satellite could then take simple defensive measures, such as shielding its imaging mirror or changing the frequency of its communications with Earth stations.

A Bolt From the Blue. Perhaps it could even strike back against its tormentor. One day, there could be "Destroyer-escort satellites" armed with "counter-battery" weapons to protect high-value satellites against earth-bound anti-satellite weapons (although, as with any weapon programmed to respond automatically to a threat, the problem of false alarms would have to be addressed).

VIII. Conclusion

Space, as the newest theater of combat, is also the most rapidly developing. The nature and character of space warfare 50 years from now may be wholly unrecognizable to those of us alive today. It would be foolish to try to freeze the nature of space warfare today within the confines of any theory, let alone one a century old.

Nevertheless, Julian Corbett's explication of the relationship between sea and land power does give us important insights into how space power relates to other military tools, at least for the coming years. Just as Corbett showed the potentials and limitations of naval power in what was to be a century dominated by great continental powers, his theory suggests both the contribution that space power can make to an overall military campaign and the new vulnerabilities it introduces in so doing. The task of space strategy will be to maximize the former while minimizing the latter. We can, after all, answer Colin Gray's question, "where is the Mahan of the final frontier?" He exists, but his name is Corbett.